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1 Introduction

I congratulate Messrs. Leonard T. Guarini and Edward P. Lotkowski on their interesting and innovative paper. I know of no other paper that purports to use a rating variable that traditionally is reserved only for physical damage coverages (i.e., model year) also to price auto liability (and injury) coverages.

My comments will be restricted to a practical observation and a minor note on the paper. From a practical perspective, I don't believe companies would use model year to price auto liability (and injury) coverages. Even if the authors' proposed use of model year were accepted and endorsed by regulators, companies would be reluctant to implement it in the marketplace due to competitive reasons and strategies.

To see this, assume that the market is competitive. All other things equal, a company that tries to use model year to price its auto liability (and injury) coverages would be driven out of the market for more recent model years and would undercut the competition on older model years. The more recent model year cars would be rated with model year factors greater than unity, while the older model year cars would be rated with factors less than unity. I don't believe companies would choose to be competitive only for older cars and leave newer cars to their competitors. This would be a poor competitive strategy even if

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older cars produce better loss ratios than newer cars. Therefore, using the model year for other than physical damage coverages would be prohibitive.

Messrs. Guarini and Lotkowski also give some reasons on the desirability and appropriateness of model year rating when compared with age rating. While the reasons are well-known to all practicing actuaries, an additional advantage of model year not stated in the paper is that model year allows companies to achieve greater differentiation in their rating structure than under age rating because ten or more model years are substituted for three to five age groups.

Authors' Reply to Discussion

Leonard T. Guarini and Edward P. Lotkowski

As both Messrs. Cheng-Sheng Peter Wu and Mohammed Q. Ashab point out in their discussions of our paper, model year rating for liability and injury coverages is an idea that must be tested not only from an actuarial perspective, but also from a general business (real world) point of view. We hope their discussions represent the beginning of a healthy debate on this subject.

Mr. Wu has provided some examples that shed some light on the workings of a model year rating system. His examples and conclusions are not coverage specific. They work equally well if one is modeling physical damage coverages or liability coverages. We have expanded Mr. Wu's set of tables to depict a scenario more likely to be found for liability than for physical damage coverages.

Assume that severities do not vary by model year, but that overall severity levels are increasing at a 5 percent annual rate. Assume further that frequency levels vary 3 percent between model years, but that overall frequency levels are not changing over time. Thus, a 3 percent model year premium increment is indicated. Using Mr. Wu's notation, we have developed Tables 1, 2, and 3.

On $10/1/z$ the system is in balance (see Table 1): the average premium equals the average pure premium. On $10/1/z + 1$, however, the average premium (Table 3) is 2 percent less than the average pure premium (Table 2), reflecting the difference between the model year increment and the annual increase in severities. Thus, a base rate increase of 2 percent is necessary to keep the system in balance.

Table 1
Data on $10/1/z$

MY	SEV	FREQ	PURE	BRATE	MYF	PREM
z	\$400	10%	\$40.0	\$37.6	1.06	\$40.0
$z-1$	\$400	9.7%	\$38.8	\$37.6	1.03	\$38.8
$z-2$	\$400	9.4%	\$37.6	\$37.6	1.00	\$37.6

Notes: MY = Model Year; SEV = Claim Severity; FREQ = Claim Frequency; PURE = Pure Premium; BRATE = Base Rate; MYF = Model Year Factor; PREM = Charged Premium.

Table 2
Expected Loss Costs on $10/1/z+1$

MY	SEV	FREQ	PURE
$z+1$	\$420	10%	\$42.0
z	\$420	9.7%	\$40.7
$z-1$	\$420	9.4%	\$39.5

Notes: MY = Model Year; SEV = Claim Severity; FREQ = Claim Frequency.

In general the model year increment is not tied directly to the annual increase in overall loss costs. The increment reflects the difference in relative cost levels among model years. This difference may bear no direct relationship to the annual rate at which loss costs are increasing.

In this example and in our paper one sees a frequency-based cost allocator implemented as a premium escalator to partially offset severity-based aggregate loss cost increases. Mr. Wu is likely correct in supposing that some regulators may have difficulty making this transition. Undeniably, the necessary connections are made more easily for physical damage coverages. Other regulators may weigh the advantages of such an approach and decide in its favor. Our view is that if liability and injury pure premiums can reasonably be expected to increase over the long term (driven either by frequency or severity) then it is reasonable to consider introducing a premium allocator as an escalator. This is especially true if the premium allocator's impact on increasing average premiums is as modest as our data suggest.

Should pure premium trends drop to low levels and be expected to remain at low levels, it would be appropriate to question the use of a

Table 3
Premium Escalation on $10/1/z+1$

MY	BRATE	MYF	PREM
$z+1$	\$37.6	1.09	\$41.0
z	\$37.6	1.06	\$40.0
$z-1$	\$37.6	1.03	\$38.8

Notes: MY = Model Year; BRATE = Base Rate; MYF = Model Year Factor; PREM = Charged Premium.

premium escalator. Of course, the ongoing manual rate review process corrects rates if they are out of balance, as the example above shows. This comment applies to physical damage as well as liability coverages. It is hard to imagine insurers discarding model year rating on physical damage coverages even if inflation were to stay in check.

Mr. Ashab wonders if insurance company management would accept model year/age rating on liability, given its impact on older versus newer cars. This is a reasonable question. The answer likely will depend on circumstances. For example, a company with a structural expense advantage that translates into a lower average premium would be in a better position to implement model year rating and still remain competitive for newer cars. Also, an organization that employs multiple companies at different rate levels may have less concern with the effect of model year/age rating on poorly maintained older cars operated by drivers with marginal driving records if it can properly assign risks to rating tiers. Finally, in a jurisdiction with administrated rates these issues may be viewed as minor, as all companies would utilize the same rating structure.

The discussants have identified several potential points of discussion. We would like to add the following points:

- Companies occasionally do not implement manual rate revisions on their planned effective dates. This usually results in reduced total premium levels. In a model year rating environment, average premiums are increasing automatically, thus mitigating the effects of delayed revisions;

- In the same vein, companies would not need to review manual rate levels as frequently in a model year rating environment. This could be important to a management reluctant to devote resources

to states with low premium volume;

- Model year/age rating reacts to the business cycle. That is, during economic downturns fewer new automobiles enter, and fewer old automobiles leave, the vehicle population. This retards premium growth under model year/age rating at the same time that the pure premium's increase is slowing, as happens during economic downturns. The opposite effect occurs as the economy recovers. These effects partially offset one another, resulting in more even operating results over a business cycle;
- Model year/age rating meets the average consumer's expectation that insurance costs more for newer cars; and
- Model year/age rating achieves the social objective of shifting insurance premiums onto those more able to afford higher premiums, as owners of newer automobiles are likely to be more affluent.

The authors appreciate the discussants' thoughtful comments and the generosity of their remarks. As we have stated, we hope to see our results tested on other data sets. If the actuarial analysis is validated, we believe that some interesting discussion may ensue.